RUDOLF VIRCHOW—PATHOLOGIST[1]

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IN his delightful autobiography, the elder Gross[2] writes of his first European visit in 1868.

There were three professional men in Berlin whom, as their names had long been familiar to me as household words, I was most anxious to see—Virchow, Langenbeck and Graefe. Accordingly, early in the morning of the second day after our arrival, I went to the Allgemeines Krankenhaus in search of Virchow, the illustrious pathologist and accomplished statesman, a professor in the university of Berlin, and a member of the German parliament. The great man, upon my entrance, was in the midst of his pupils, engaged in a post-mortem examination. As my presence attracted some attention, ... I deemed it my duty, although the moment was not the most opportune, to pass my card to the professor, at the same time apologizing for the intrusion. He at once saluted me with a gracious bow, and, shaking me cordially by the hand, introduced me to his pupils and expressed his gratification at seeing me. After a few minutes spent in conversation, he resumed his knife and completed his examination. He showed me his laboratory, his lecture-room, and many of his more interesting pathological specimens, most of them prepared by his own hands. His collections of diseased hearts of children, the result of inherited syphilis, is the largest in the world, and, as he explained specimen after specimen, he became not only enthusiastic but eloquent . . . . The laboratory, or work-shop as it may be termed, of Professor Virchow is a model in its way, admirably adapted to the wants of the student for improvement in the use of the microscope and the examination of morbid specimens. . . . Microscopes are provided in great numbers, and, in fact, every facility is afforded for the acquisition of knowledge. . . . . Such a room with the necessary appliances ought to exist in every well-organized medical institution in the United States.

Dr. Gross died in 1884, so that he lived to see but the slightest realization of this wish, which has now reached a degree of fulfilment beyond the greatest anticipation either of Virchow himself or of his contemporaries.

To continue Dr. Gross's personal narrative—and I can do no better in order to give an intimate acquaintance with him whose centennial we celebrate:

[1]A paper read at a meeting of the Research Club, University of Michigan, April 20, 1921, in commemoration of the centennials of Hermann von Helmholtz and Rudolph Virchow.

[2]Autobiography of Samuel D. Gross. G. Barrie, Philadelphia, 1887. Vol. 1, p. 231-235.

Virchow is a most patient and laborious investigator and yet he never seems to be in a hurry. His dissections [autopsies][3] seldom occupy fewer than two and a half or three hours each. Every organ of the body is thoroughly explored. For years past his habit has been to open, every Monday morning, a cadaver in the presence of his private pupils with a view of instructing them in the art of conducting autopsies—holding the knife, using the saw, and taking notes, the whole being supplemented by microscopic inspections of the more important diseased structures. In these dissections he is, if possible, more patient even than Rokitansky, his great Viennese prototype.

Virchow is a thin, slender man, about the medium height, with a fine forehead, although the head is not large, and handsome black eyes, concealed by a pair of glasses. He is deliberate in his movements, a good talker, very affable, courteous and warm-hearted—in a word, a gentleman of the higher type.

The evening before Dr. Gross left Berlin he had further occasion to appreciate Virchow's splendid courtesy. While he was the guest of honor at Virchow's own table, together with von Langenbeck, von Graefe, the oculist, Donders, Gurlt and others, the host drew from under the table a large book, which proved to be the second edition of Gross's "Elements of Pathological Anatomy," and, rising, took his guest by the hand and in a graceful speech referred to the text as one from the study of which he had derived much useful instruction and one which he always consulted with much profit.

American medicine has too seldom received that full appreciation in Berlin and Vienna that Virchow was always willing to give. In reviews and abstracted articles edited by him one is struck by the large number of English and American references included.

Nearly twenty years after the visit of Gross to Berlin, we find Sir William Osler a pilgrim in Virchow's laboratory. Perhaps it has been the growing breadth of vision during those years, but not unlikely it is the wonderful catholicity of interests, possessed by the great visitor himself which changes the character of the pen picture. Part of his narrative I must reproduce even though it reaches beyond the limits of my subject. Osler[4] writes:

In 1884, on returning to Berlin for the first time since my student days, I took with me four choice examples of skulls of British Columbian Indians, knowing well how acceptable they would be. In his room at the Pathological Institute, surrounded by crania and skeletons, and directing his celebrated *diener,* who was mending Trojan pottery, I found the professor noting the peculiarities of a set of bones which he had just received from Madeira. Not the warm thanks, nor the cheerful, friendly greeting which he always had for an old student, pleased me half so much as the prompt and decisive identification of the skull which I had brought, and his rapid sketch of the cranial characters of the North American Indian. The profound expert, not

[3]Bracketed words are inserted by the author.

[4]Osler, William. Virchow, the man and the student, Johns Hopkins University Circulars, 1891, XI, 17-20.

the dilettante student has characterized all of his work in this line . . . As an illustration of his capacity for varied work, I recall one day in 1884, in which he gave the morning demonstration and lecture at the Pathological Institute, addressed the Town Council at great length on the extension of the canalization scheme, and made a budget speech in the House, both of which were reported at great length in papers of the next day.

Rudolf Virchow graduated in medicine from the Friedrich-Wilhelm Institute in 1843 with the dissertation *De rheumate praesertim corneae.* In the autumn of 1844, he became an assistant in pathological anatomy under Froriep, and in 1846 he was appointed prosector in the same clinic. He became a lecturer in the University of Berlin in 1847. Possessing vigorous political views, which would be considered liberal even today, he lost his university connections during the stormy period of 1848 and 1849, largely through the publication with Leubuscher of a half-medical, half-political journal, which they styled *Medicinische Reform.* From 1849 to 1856 he occupied the chair of pathological anatomy at Würzburg, where, working with the greatest industry, he raised his department to foremost rank and pursued investigations upon which much of his later work was based. At the end of that period, he was recalled to Berlin as professor of pathological anatomy and director of the newly established pathological institute in Berlin University, with which he was connected until his death.

To understand Virchow's relation to pathology and to medicine is to understand something of the stages through which scientific medicine has passed in the last one hundred and fifty years. We are now, and have been for some fifty years, in a period characterized by search for the etiological factor in disease. In part, the bacteriologist has been in the ascendency and we already have sufficient perspective to see the greatness of Pasteur and Koch. Among our contemporaries there may be those equally to be honored by another generation. Moreover, there are those who would have us believe that we are even now passing from the epoch of bacteriology into a period dominated by biochemistery, serology and immunology, but upon this transition, if, indeed, it should be dignified as such, light is still to be shed.

At any rate, these present-day tendencies will serve to illustrate the shifting emphasis in medical progress. Does it mean that the stage has been set for a certain scene, or that a brilliant and indefatigable worker, inspiring a group of collaborators, strides off into the unknown? As we read current medical history, the advance appears to be gradual and simultaneous along interdigitating lines. In retrospect, the advance assumes the topography of a series of steps rising from plateau-like surfaces. The highest step of the nineteenth century was the rise of microscopical pathology as established and developed by Rudolf Virchow.

Cellular pathology rose from a foundation of gross pathology. In the later half of the preceding century John Hunter had developed his wonderful museum of gross preparations of both normal and pathological anatomy. He had had the hardihood to apply objective experimental methods to the investigation of pathological problems. Through the experimental production of arterial anastomoses, he found that it was possible to ligate arteries whose flow had previously been considered essential to the life of a part. For Hunter, Virchow had the greatest admiration, and it has been said that for a long time Hunter's picture alone was found upon the walls of his laboratory. Fifty years or so after Hunter, Rokitansky in Vienna brought the period of gross pathology to its greatest height. The first autopsy protocol written in his own hand is dated October 23, 1827. In March, 1866, he achieved his thirty thousandth post-mortem examination. It is said that before his death he had access to 100,000 protocols of autopsies done by himself and his assistants. With this enormous material he brought descriptive gross pathology to a degree of perfection never before realized.

As will be noted by the dates just given, Rokitansky was well established in his field of gross pathology when Virchow read his inaugural dissertation. In fact, Virchow was still in his assistantship when the first volume of Rokitansky's *Lehrbuch der pathologischen Anatomie* appeared in 1845. With the microscope at his disposal, his independence of thought, his originality in attack, and, above all, his ability to exalt pure objective description as an end in itself made it possible for Rudolf Virchow to do for the pathology of the cell what Rokitansky had done for the pathology of the organ and tissue.

All medicine before Virchow had been burdened with mysticism, dogma and hypothesis. Witness the pertinacity with which the humoral theory survived in its varying forms, even to the extent of obscuring the earlier part of Rokitansky's work. All this Virchow was able to cast aside and, avoiding dogma, he developed a method rather than a theory.

To those who would lessen the importance of Virchow's work by reference to Bichat, it need but be said that while the latter did resolve the various organs and tissues of the body into twenty-one simple, and, as he supposed, elemental types, this analysis was done on the basis of naked-eye observation alone. Bichat did not use the microscope. Like Virchow, however, he placed the objective detailing of facts before speculation. To Schleiden and Schwann, Virchow gave full credit for the earlier development of the idea of the animal cell as interpreted in terms of cellular botany. Yet, it must be remembered that to a great extent Virchow was called upon to formulate for himself standards of normal histology as well as to describe the changes produced in the cell by disease.

No adequate analysis of Virchow's published work can be given here. Its volume is remarkable. In 1901, Schwalbe[5] and others whose assistance he invited, compiled a Virchow bibliography as their part in the celebration of the eightieth birthday of their old master. In the preface, Schwalbe himself says that a Virchow bibliography lays bare not alone the life-work of a man, but exposes as well a history of medicine and anthropology for the preceding sixty years. Requiring 118 pages, with an average of about eighteen items to the page, this list of approximately 2,000 titles bears witness to the industry, breadth of interest and critical scientific discrimination of the cellular pathologist. From all of this material I can refer only to the two most important books, to the journals developed under his leadership and to a few of the most important articles.

"Die Cellularpathologie" appeared in 1858. This book, presented in the form of twenty lectures illustrated by numerous wood cuts, placed before the world for the first time a summation of the author's views. Here was demonstrated that the principle of *omnis cellula e cellula*, which he was first to put into words, applied equally to pathological formations and to normal embryologic development. Translated into French by Picard and into English by Frank Chance, "Cellular Pathology" was seized upon with an avidity which must have surprised even its author. From that year modern pathology is to be dated. We cannot appreciate the effect upon Medicine of this new point of view. Before, all morbid products, tumors, cancers, purulent collections, tubercles, gummas had been explained as arising in, or from, a hypothetical primitive blastema, itself exudative in nature. Now these were shown to be composed of living body cells, differing in various ways from the normal, exhibiting alterations both in form and function. With histological technique in its infancy, much was incomplete and misinterpretations were bound to occur, even as they do to-day.

Let me illustrate the accuracy of observation shown in the "Cellular Pathology" by quotations dealing with the subject of argyria, the deposit of silver pigment in the tissues. Every student of pathology now knows that argyriasis shows a selective affinity for the fibrillae of connective tissue. Silver is not deposited in epithelial structures, although it usually gains entrance to the body by passing through an epithelium. Note how clearly Virchow states these facts.

> We know that when any one takes salts of silver, they penetrate into the different tissues of his body. . . . A patient who had . . . received a solution of nitrate of silver as a lotion [for the eyes], very conscientiously employed the remedy . . . ; the result of which was that his conjunctiva

[5]Schwalbe, J. Virchow-Bibliographie, 1843-1901. G. Reimer, Berlin, 1901. Pp. 183.

assumed an intensely brown, nearly black appearance. The examination of a piece cut out of it showed that silver had been taken up into the parenchyma, and indeed in such a manner that the whole of the connective tissue had a slightly yellowish brown hue upon the surface, whilst in the deeper parts the deposition had taken place only in the fine elastic fibers of the connective tissue, the intervening parts, the proper basis-substance, being perfectly free. But deposits of an entirely similar nature take place also in more remote organs. Our collection contains a very rare preparation from the kidneys of a person who on account of epilepsy had taken nitrate of silver internally. In it may be seen the Malpighian bodies, in which the real secretion takes place, with a blackish blue coloring of the whole of the membrane of the coil of the vessels, limited to this part of the cortex, and appearing again, in a similar, though less marked form, only in the intertubular stroma of the medullary substance. . . . . The salts of silver do not deposit themselves in the lungs [when present in the circulating blood], but pass through them to be precipitated only when they reach the kidneys or the skin.

Taking second place in importance among the larger works of Virchow, is the three volume treatise on tumors, "Die Krankhaften Geschwülste." This was completed in the years 1863-1867. In it Virchow develops a systematic classification of neoplasms based largely upon their microscopical characteristics. Here the influence of his teacher, Johannes Müller, is evident. The terminology used by Virchow in this work still survives to a large degree.

Of the great array of lesser works, I can mention but a few groups. In the late forties Virchow, published a series of epoch-making papers on disturbances of the circulation. Here for the first time phlebitis, thrombosis, metastasis and embolism were clearly set forth. In fact, the term Embolia, or as we now say, embolism, was introduced by Virchow himself. Osler relates that in 1848, at the height of Virchow's political activity, he performed an autopsy upon a patient, said by Schönlein to have died from cerebral hemorrhage. Virchow found no hemorrhage, but succeeded in demonstrating an embolus blocking an important cerebral artery. Schönlein, who was present to see the outcome of his diagnosis, turned to Virchow and in a half-joking, half-vexed manner, said *Sie sehen auch überall Barricaden.* Other important monographs, papers and groups of papers were those dealing with calcium metastasis, pathological pigmentation, amyloid, leukaemia, chlorosis, phosphorus poisoning, syphilis, trichinosis, rickets, cretinism, encephalitis and peptic ulcer. The list might be much extended.

In 1847, Virchow with Reinhardt founded the *Archiv für pathologische Anatomie und Physiologie und für klinische Medicin.* This journal has been continued since that time, and constitutes the most important collection of original contributions to scientific medicine. After Reinhardt's death in 1852, Virchow carried the editorship alone for many years, so that even now one finds as many citations to this journal by the phrase "Virchow Archiv" as by its proper title. From 1851 to 1893

he was the joint editor, and from 1893 to 1901 the sole editor, of Canstatt's *Jahresbericht über die Leistungen und Fortschritte in der gesammten Medicin.* From 1850 to 1862, Virchow shared with Kölliker, Scherer and Scanzoni the editorship of the *Verhandlungen der physikalisch-medicinischen Gesellschaft in Würzburg.*

A list of Virchow's pupils would include most of the makers of medicine of the last fifty years. Scattered throughout the civilized world, they have from time to time brought together in *Festschriften* and memorial celebrations lists of names and collections of original contributions of which their old master may well have been proud. The *Festschrift* for his seventy-first birthday contributed by his former, and then acting, assistants in the Berlin Pathological Institute includes in its table of contents the names of v. Rechlinghausen, Klebs, Salkowski, Orth, Grawitz and Langerhans, among others, all of whom have had a great influence on the development of pathology and modern medicine. American medicine owes much to those who were under Virchow's tutelage in the last three decades of the nineteenth century.

Virchow was wrong. The cell is not the ultimate unit of life, but the methods of cellular pathology have grown no less important since he gave his great work to the world. The cell with its miscroscopically demonstrable content is still the morphological unit of life. Disease processes are still interpreted in the light of the cellular changes.

To Virchow we owe our conception of disease. Disease is not an entity, entering the body from without. Disease is life, life which deviates from the normal. The casual factor may reside within or may come from without in the form of trauma, infection, intoxication, or what not, but the cause is not the disease. The disease is the abnormal life of the body cells. The methods of modern medicine are therefore broadly biologic, and along this road of promise Rudolf Virchow pointed the way.